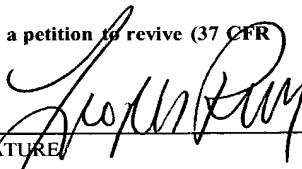


FORM PTO-1390 (Modified) (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				15353
INTERNATIONAL APPLICATION NO. <b>PCT/AU00/01089</b>		INTERNATIONAL FILING DATE <b>13 September 2000 (13.09.00)</b>		U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>Unassigned 10 / 088435</b>
TITLE OF INVENTION <b>GLUTEN SUBSTITUTES</b>		PRIORITY DATE CLAIMED <b>14 September 1999 (14.09.99)</b>		
APPLICANT(S) FOR DO/EO/US <b>Frank Uhlik</b>				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.</li> <li><input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li><input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))             <ol style="list-style-type: none"> <li><input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li><input checked="" type="checkbox"/> has been communicated by the International Bureau.</li> <li><input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li><input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).             <ol style="list-style-type: none"> <li><input type="checkbox"/> is attached hereto.</li> <li><input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li><input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))             <ol style="list-style-type: none"> <li><input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li><input type="checkbox"/> have been communicated by the International Bureau.</li> <li><input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li><input checked="" type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li><input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> <li><input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li><input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> </ol>				
<b>Items 13 to 20 below concern document(s) or information included:</b>				
<ol style="list-style-type: none"> <li><input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li><input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li><input type="checkbox"/> A <b>FIRST</b> preliminary amendment.</li> <li><input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> <li><input type="checkbox"/> A substitute specification.</li> <li><input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li><input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</li> <li><input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li><input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</li> <li><input checked="" type="checkbox"/> Certificate of Mailing by Express Mail</li> <li><input checked="" type="checkbox"/> Other items or information:</li> </ol>				
<b>Courtesy Copy of International Application</b> <b>"Small Entity status is entitled to be asserted in respect to the above-identified patent application"</b>				

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 104088435 assigned)	INTERNATIONAL APPLICATION NO. PCT/AU00/01089	ATTORNEY'S DOCKET NUMBER 15353			
24. The following fees are submitted:		CALCULATIONS PTO USE ONLY			
<b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :</b> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00</li> <li><input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00</li> </ul>					
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>		<b>\$1,040.00</b>			
Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e))		<input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 <b>\$130.00</b>			
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	67 - 20 =	47	x \$18.00	<b>\$846.00</b>	
Independent claims	3 - 3 =	0	x \$84.00	<b>\$0.00</b>	
Multiple Dependent Claims (check if applicable).		<input type="checkbox"/>		<b>\$0.00</b>	
<b>TOTAL OF ABOVE CALCULATIONS =</b>		<b>\$2,016.00</b>			
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27) The fees indicated above are reduced by 1/2.		<b>\$1,008.00</b>			
		<b>SUBTOTAL = \$1,008.00</b>			
Processing fee of <b>\$130.00</b> for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).		<input type="checkbox"/> 20 <input type="checkbox"/> 30    + <b>\$0.00</b>			
<b>TOTAL NATIONAL FEE =</b>		<b>\$1,008.00</b>			
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).		<input type="checkbox"/> <b>\$0.00</b>			
<b>TOTAL FEES ENCLOSED =</b>		<b>\$1,008.00</b>			
		Amount to be: refunded		\$	
		charged		\$	
a. <input checked="" type="checkbox"/> A check in the amount of <b>\$1,008.00</b> to cover the above fees is enclosed.					
b. <input type="checkbox"/> Please charge my Deposit Account No _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed.					
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <b>19-1013/SSMP</b> A duplicate copy of this sheet is enclosed.					
d. <input type="checkbox"/> Fees are to be charged to a credit card. <b>WARNING: Information on this form may become public. Credit card information should not be included on this form.</b> Provide credit card information and authorization on PTO-2038.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO:					
<b>Leopold Presser</b> <b>Registration No. 19,827</b> <b>SCULLY, SCOTT, MURPHY &amp; PRESSER</b> <b>400 Garden City Plaza</b> <b>Garden City, NY 11530</b> <b>(516) 742-4343</b>		 <b>SIGNATURE</b> <b>Leopold Presser</b> <b>NAME</b> <b>19,827</b> <b>REGISTRATION NUMBER</b> <b>March 14, 2002</b> <b>DATE</b>			

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PCT/AU00/01089

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## GLUTEN SUBSTITUTES

### **FIELD OF THE INVENTION**

The present invention relates generally to the preparation of food products that are typically produced using wheat flour. More particularly, the present invention relates to 5 novel gluten substitutes and methods for their production for use *inter alia* in the preparation of bread, cake and pastry-type products.

### **BACKGROUND OF THE INVENTION**

Bakery products are commonly made from wheat flour containing gluten, which contributes to the typical texture, flavour and form of the usual bread, cake and pastry 10 products. A substantial segment of the population, however, suffers from dietary wheat intolerance such as celiac disease and other less well-defined wheat intolerances and allergies which make wheat based products unacceptable for use. Unfortunately, these people have few alternatives for conventional baked products.

Despite the desirability of developing bakery products that are not based on wheat 15 flour, this development has been hindered largely by the unavailability of alternative compounds that mimic the critical role that gluten plays in the baking process. Gluten is especially important in this regard because of its unique ability to form the viscoelastic matrix of dough, which transforms it into a firm loaf of bread when baked. However, gluten-free flours typically have very little, if any, binding capacity and consequently, form 20 pastes or slurries instead of dough when mixed with yeast and water.

Current methods for producing gluten-free bread, for example, include mixing 25 gluten-free flour with water, eggs, salt, sugar, yeast, milk and a small amount of binding agent (0.5 to 5.0% by weight), usually xanthan gum, guar gum, or pre-gelatinized starch typically referred to as a gluten substitute. Unfortunately, the resulting breads are very cake-like and heavy whilst their mouth feel and texture are generally unpleasant. As a result, many gluten intolerant individuals avert eating bread products all together.

By further example, dough can be made from gluten-free flour mixed with commercially available gluten. If the gluten is mixed with these flours in the amount of 15

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to 20% by weight (i.e., in an amount 3-40 times greater than the above mentioned gluten substitutes) and then combined with water, a strong dough results, capable of being manipulated in much the same way as dough made from naturally-occurring gluten based flours. However, this dough contains gluten and cannot be used for gluten intolerant  
5 individuals.

Casual observations of commercially available gluten powder when mixed with water shows some distinct and easily recognizable properties. The mixture quickly becomes a very strong gum that takes considerable effort to stretch or snap. When snapped into separate pieces, it can be re-constituted into a single whole, simply by kneading it  
10 back together. If left to dry, it forms a shiny skin whilst remaining moist on the inside.

From the foregoing, it is desirable to produce a gluten substitute, which can be used to prepare gluten-free food products and which ameliorates at least one of the aforesaid disadvantages of the prior art.

#### SUMMARY OF THE INVENTION

The present inventor has surprisingly discovered that a gluten substitute gum can be produced by heating an aqueous mixture comprising a starch, an edible fat and an edible protein for a time and under conditions sufficient to produce an aerated mass. When mixed with water, this aerated mass largely mimics gluten in that it takes considerable effort to stretch or snap. When snapped into separate pieces, it can be re-constituted into a single  
15 whole simply by kneading it back together. It also forms a shiny skin when left to dry whilst remaining moist on the inside. When mixed with flour, whether gluten-free or otherwise, a dough is formed quickly. The dough absorbs water at a similar rate to wheat flour-based dough, strengthens with kneading and can be stretched or rolled to very thin consistency in a similar manner to wheat flour-based doughs. The foregoing discoveries  
20 have been reduced to practice in novel gums and methods for their production as well as novel compositions and kits for the preparation of bakery and other food products as  
25 described hereinafter.

Accordingly, in one aspect of the present invention, there is provided a method of producing a gluten substitute gum, said method comprising heating a mixture comprising a  
30 starch, an edible fat and an edible protein together with a liquid for a time and under

conditions sufficient to form an aerated mass.

In another aspect, the invention contemplates a plurality of ingredients in mix or in kit form for producing a gluten substitute gum, said ingredients comprising a starch, an edible fat and an edible protein which are present in relative amounts sufficient to form an  
5 aerated mass upon mixing with a predetermined amount of liquid and heating the mixture so formed at an aerated mass-forming effective temperature.

In yet another aspect, the invention encompasses use of a starch, an edible fat and an edible protein in the preparation of a mix or kit for the production of a gluten substitute gum.

10 In still yet another aspect, the invention provides a gluten substitute gum produced by mixing together a starch, an edible fat, an edible protein and a liquid and heating the mixture for a time and under conditions sufficient to form an aerated mass.

In a further aspect of the invention, there is provided a mix for the preparation of bakery products, said mix comprising a gluten substitute gum as broadly described above  
15 together with a gluten-free starch in relative amounts sufficient to form a coherent dough system upon the addition of a liquid, and to retain leavening gas during the preparation of said dough, wherein said products are producible in the substantial absence of wheat flour.

20 In another aspect, the invention contemplates use of a gluten substitute gum as broadly described above in the preparation of a mix for producing foodstuffs including bakery products.

According to yet another aspect, the invention provides a method for producing bakery products, said method comprising mixing a gluten substitute gum as broadly described above together with a gluten-free starch and water to form a dough and heating the dough for a time and at a temperature sufficient to produce said bakery products.

25 In yet another aspect, the invention resides in food products including bakery products produced using the gluten substitute gum as broadly described above.

**DETAILED DESCRIPTION OF THE INVENTION*****1. Definitions***

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by those of ordinary skill in the art to which the invention belongs. Although any methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, preferred methods and materials are described. For the purposes of the present invention, the following terms are defined below.

The articles "a" and "an" are used herein to refer to one or to more than one (i.e. 10 to at least one) of the grammatical object of the article. By way of example, "an element" means one element or more than one element.

Throughout this specification, unless the context requires otherwise, the words "comprise", "comprises" and "comprising" will be understood to imply the inclusion of a stated step or element or group of steps or elements but not the exclusion of any other step 15 or element or group of steps or elements.

By "edible fat" or "edible protein" is meant a fat or protein that is fit or safe for animal consumption including human consumption.

***2. Gluten substitute gum***

The present invention is predicated in part on the discovery that a gluten substitute 20 gum can be produced by heating a mixture, preferably an aqueous mixture comprising a starch, an edible fat and an edible protein for a time and under conditions sufficient to produce an aerated mass with gluten-like properties. The invention thus provides a method of producing a gluten substitute gum, comprising heating a mixture comprising a starch, an edible fat, an edible protein and a liquid, preferably water, for a time and under 25 conditions sufficient to form an aerated mass.

Preferably, the starch is present in an amount of between about 20 and 80% by weight, more preferably between about 30 and 70% by weight and even more preferably between about 40 and 60% by weight of said mixture.

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Suitably, the starch has less than 20 parts per million of gluten. In this connection, the starch preferably conforms to the Codex Alimentarius standard as set by the World Health Organization.

The starch is suitably selected from potato starch, sweet potato starch, white rice starch, glutinous rice starch, maize starch, Codex Alimentarius wheat starch, sorghum starch, cassava starch, arrowroot starch and tapioca starch. Preferably, the starch is selected from the group consisting of tapioca starch, arrowroot starch and maize starch. More preferably, the starch is tapioca starch.

The edible fat suitably comprises any edible fatty substances in a general sense, including, but not restricted to, natural fats or synthesized fats and oils consisting essentially of triglycerides. The fat may be derived from any animal or plant source including, for example, canola oil, corn oil, grapeseed oil, soybean oil, sunflower seed oil, safflower oil, rapeseed oil, cottonseed oil, sesame oil, olive oil, palm oil, coconut oil, fish oil, copha, margarine, butter, milk fat, chicken fat, lard and tallow, which may have been partially or completely hydrogenated or modified otherwise, as well as non-toxic fatty materials having properties similar to triglycerides and any combination thereof. The terms fat and oil are used interchangeably. The edible fat may be solid or fluid at room temperatures of from about 15 °C to about 35 °C.

Preferably, the edible fat is present in an amount of between about 1 and 10% by weight, more preferably between about 1 and 6% by weight and even more preferably between about 1 and 4% by weight of said mixture.

It is preferred that the edible fat to starch ratio in said mixture is less than about 15:100, more preferably less than about 12:100, more preferably less than 10:100.

The edible protein suitably comprises any edible proteinaceous substance synthetic or otherwise that is suitable for human consumption. Typical protein sources from which the edible protein may be derived include, but are not restricted to, animal produce such as meat, poultry, eggs, milk, cheese and the like, and plant produce such as bean flour, rice flour and the like as well as nuts such as peanuts, hazelnuts, walnuts, sunflower seeds, cashews, sesame seeds, pumpkin seeds, almonds, pine nuts, macadamia nuts, any other edible nut and any combination thereof. Exemplary animal proteins

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include but are not limited to, gelatin, whey and egg white. Exemplary plant proteins include soybean protein and rice protein.

Preferably, the edible protein is present in an amount of between about 2 and 20% by weight, more preferably between about 2 and 12% by weight and even more preferably 5 between about 2 and 8% by weight of said mixture.

It is preferred that the edible protein to starch ratio in said mixture is less than about 30:100, more preferably less than about 25:100, more preferably less than 20:100.

Preferably, the edible protein to edible fat ratio is about 3:1, more preferably about 2.5:1 and still more preferably about 2:1.

10 Water is preferably present in said mixture in an amount of between about 20 and 80% by weight, more preferably between about 30 and 70% by weight and even more preferably between about 40 and 60% by weight of said mixture

In a preferred embodiment, the edible fat and the edible protein are obtained from or provided in the form of a foodstuff comprising both the edible fat and the edible protein. 15 For example, the foodstuff may be selected from milk or other dairy products, eggs, vegetables. Preferably, the foodstuff is a gluten-free flour such as, for example, buckwheat flour, sorghum flour, maize flour, white rice flour and soybean flour. More preferably, the foodstuff is soybean flour.

20 Preferably, the mixture is heated to a temperature of between about 110 and 150 °C, more preferably between about 120 and about 140 °C, more preferably between about 125 and 135 °C and still more preferably between about 130 and 133 °C.

Any mode of heating, which is suitable for the formation of the aerated mass, is contemplated by the present invention. Preferably heating is effected by microwaves. Alternatively, the heating can be carried out by use of a compression means such as an 25 extruder.

Suitably, the mixture is heated for a time sufficient to produce the aerated mass without burning.

Preferably, the method further comprises drying the aerated mass. The drying

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may be effected by any suitable means including, but not restricted to, heating the aerated mass to effect evaporation of water therefrom. The heating may be effected using microwaves, extrusion, convection heating, blow drying and desiccating or any other means to effect evaporation of water from the aerated mass.

5         Suitably, the method further comprises grinding or crushing the dry aerated mass to form a ground or powder.

The gluten free gum can be used for the preparation of foodstuffs including bakery products in the form of a wet gum but is preferably used in the form of a dried ground or powder.

10        The invention also contemplates a plurality of ingredients in mix or in kit form for producing a gluten substitute gum. The ingredients comprise a starch, an edible fat and an edible protein which are present in relative amounts sufficient to form an aerated mass upon mixing with a predetermined amount of water and heating the mixture so formed at an aerated mass-forming effective temperature.

15        Preferably, the edible fat is present in an amount between about 0.5 and 5% by weight, more preferably between about 0.5 and 3% by weight and even more preferably between about 0.5 and 2% by weight of the total ingredients in said mix or kit.

The edible fat to starch ratio in said mix or kit is preferably less than about 15:100, more preferably less than about 12:100, more preferably less than 10:100.

20        Preferably, the edible protein is present in an amount of between about 1 and 10% by weight, more preferably between about 1 and 6% by weight and even more preferably between about 1 and 4% by weight of said the total ingredients in said mix or kit.

The edible protein to starch ratio in said mix or kit is preferably less than about 30:100, more preferably less than about 25:100, more preferably less than 20:100.

25        Preferably, the edible protein to edible fat ratio in said mix or kit is about 3:1, more preferably about 2.5:1 and still more preferably about 2:1.

The invention also provides a gluten substitute gum produced by mixing together a starch, an edible fat, an edible protein and a liquid and heating the mixture for a time and

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under conditions sufficient to form an aerated mass.

The invention also encompasses a mix for the preparation of bakery products. The mix comprises the gluten substitute gum of the invention together with a gluten-free starch in relative amounts sufficient to form a coherent dough system upon the addition of 5 water, and to retain leavening gas during the preparation of said dough. The ratio of starch to gluten-substitute gum will vary depending on the intended purpose of the mix. However, for most bakery products the ratio of starch to gluten-substitute gum is preferably in the range of about 6:1 to 7:1.

It will be appreciated that the gluten-substitute gum of the invention can thus be 10 used to prepare various mixes for cakes, pastries and bread products. These mixes can include other standard ingredients known *per se* in the art and the choice and grade of said other ingredients in a complete mix are not critically related to the invention and may follow standard practice in the art. Thus, the invention contemplates use of any of the usual basic gas producing chemical leavening substances as well as flavorings in the 15 aforesaid mixes.

Accordingly, the invention also provides a method for producing bakery products. The method comprises mixing the gluten substitute gum of the invention together with a gluten-free starch and water and optionally other ingredients to form a dough and heating the dough for a time and at a temperature sufficient to produce said bakery products.

20 Bakery products contemplated by the present invention include, but are not restricted to, flour, bread, buns, rolls, bagels, pizza base, pies, pastry, pancakes, muffins, crumpets, doughnuts, cakes, batter, biscuits, cake mixes, dumplings, and pasta.

The invention also encompasses any food products produced using the gluten 25 substitute gum of the invention. In this connection, the subject gluten substitute gum has excellent thickening and binding properties. Accordingly, the gum can be advantageously used as a food additive, both for human and animal consumption. For example, when the gluten substitute gum is used as a thickener, it can compete effectively with modified starches, xanthan, guar and many other gums. Exemplary foodstuffs which can be prepared using the present gluten substitute gum include, for example, sauces, soups,

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pastes, mayonnaise, dressings, snack foods, deserts, gravies, processed meats including sausages, salamis, hot dogs as well as canned and re-constituted pet foods.

In order that the invention may be readily understood and put into practical effect, particular preferred embodiments will now be described by way of the following non-limiting examples.

### EXAMPLES

#### *EXAMPLE 1*

##### Preparation of a gluten substitute gum using tapioca starch and soybean flour

Ingredients	Gum #1	Gum #2	Gum #3	Gum #4	Gum #5
Tapioca starch	100 g				
Soybean flour	25 g	37.5 g	20 g	10 g	5 g
Water	92 g	160 g	120 g	110 g	105 g

10        Each mixture of the above ingredients was blended into a wet paste, which was baked in a 750-Watt domestic microwave oven, on maximum setting at a rate of about 10 minutes per 2 x 100 g of paste. At 2 minutes this procedure yielded an aerated mass, which had expanded to about double the volume of the paste before baking. At 3 minutes the aerated mass had expanded to 3 times the volume of the paste before baking.

15        Temperature analysis revealed that the aerated mass was formed in the range of from about 130-133 °C. At 10 minutes this procedure produced a dried solid mass. The dried mass was allowed to cool for several minutes before it was milled and crushed into a powdered gum. It should be noted, however, that excess baking produces charring. Thus, for a given heating/baking apparatus care should be taken to determine the optimal baking period per weight of paste. A person of skill in the art can determine these variables routinely in view of the present disclosure without undue experimentation.

A scaled-up preparation of Gum #5 was also carried out using a 6850-Watt microwave assisted heat pump drier. This preparation comprised baking 800 g of wet

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paste for about 8-9 minutes at about 5000 Watts (power/weight of paste ratio of about 8-14:1). The dry gum thus produced had similar properties to Gum #5 produced with the domestic microwave.

### ***EXAMPLE 2***

#### **5 Preparation of a gluten substitute gum by extrusion**

Dry powder (95 wt% tapioca starch, 5 wt% soybean flour) was fed into an extruder at a rate of 80 kg/hour. Steam was added to the dry powder in the preconditioner at a rate of 9.5 to 10.5 kg/hour. The process was started wet, and water addition into the barrel of the extruder was steadily reduced to increase pressure and therefore temperature.

10 Screw speed was also adjusted to keep motor amps (30 or 28 amps) (and therefore mechanical shear) as low as possible. A relatively high screw speed of (375 or 373 rpm) was used. The operating temperatures at which samples were collected are shown in the following table. No jacket heating was applied in Zone 5. Thus, Zone 5 temperature is a good indication of the maximum product temperature achieved.

Extrusion Parameter	Gum #6	Gum #7
Dry feed rate (kg/hour)	80	80
Steam addition to preconditioner (kg/hour)	10.3	9.5
Discharge temperature from preconditioner (°C)	45	48
Extruder screw speed (rpm)	375	373
Extruder motor amps	30	28
Water addition into barrel (kg/hour)	6.6	9.3
Temperature Zone 1 (°C)	43	47
Temperature Zone 2 (°C)	71	56
Temperature Zone 3 (°C)	78	60
Temperature Zone 4 (°C)	114	100
Temperature Zone 5 (°C)	149	144
Pressure at die (bar)	28	25

The product, which exited from the die, expanded significantly and was cut into balls before cooling and milling through a hammer mill.

### **EXAMPLE 3**

#### **5 Comparison of microwave oven produced (M) and extruder produced (E) gums**

<i>Property</i>	<i>Gum M</i>	<i>Gum E</i>
<i>Weight per liter</i>	870 g	560 g
<i>Water absorption per 100 g of gum to form a solid mass</i>	92 g	50 g
<i>Gum characteristics</i>	<p>Rapidly disperse water through dry gum</p> <p>Forms a solid mass with strong cohesion</p> <p>Adheres to itself instead of other materials</p> <p>Has no perceptible odour</p> <p>Requires almost equal amounts of water to gum to form a mass</p> <p>Swells during absorption of water</p> <p>Weight to volume ratio similar to gluten</p>	<p>Does not disperse water through dry gum</p> <p>Forms a sticky liquid at point of contact with water. Water does not penetrate into dry gum.</p> <p>Initially adheres to other materials but becomes self-adherent with additional mixing.</p> <p>Has a fruit-like odour</p> <p>Requires about half the amount of water to gum to form a mass</p> <p>Contracts during absorption of water</p> <p>Weight to volume ratio smaller than gluten (<i>i.e.</i>, it has larger, lighter bulk)</p>
<i>Dough characteristics</i>	<p>Requires approx. 160 g/kg of gum to starch to make a dough</p> <p>Requires about 580 g water per kg flour to make a good dough (equivalent to wheat</p>	<p>Requires approx. 200 g/kg of gum to starch to make a dough</p> <p>Requires about 470 g water per kg flour to make a good dough (19% less than wheat flour)</p>

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<i>Property</i>	<i>Gum M</i>	<i>Gum E</i>
<i>Bake characteristics</i>	<p>flour)</p> <p>Flour readily mixes with water to make a good dough</p> <p>Dough is mixed to similar consistency as wheat (moisture, feel, stretch and stickiness)</p> <p>Has single rise (in about 20 minutes @ 50°C)</p> <p>Will not rise further when baking heat applied</p>	<p>Flour forms a small central wet spot that must be mixed for several minutes to collect and incorporate loose flour</p> <p>Dough is mixed to a consistency which is not similar to wheat (feels much drier, does not have similar stretch characteristics)</p> <p>Has single rise (in about 30-40 minutes @ 50°C)</p> <p>Rises further when baking heat applied</p>

**EXAMPLE 4**Preparation of a gluten substitute gum using tapioca, edible fat and edible protein

<i>Ingredients</i>	<i>Gum #8</i>	<i>Gum #9</i>	<i>Gum #10</i>	<i>Gum #11</i>	<i>Gum #12</i>
Tapioca starch	50 g	50 g	50 g	50 g	50 g
Dried egg white	-	3 g	-	3 g	-
Olive oil	-	-	3 g	3 g	-
Whole milk powder (28wt% protein, 26wt% fat)	-	-	-	-	22 g
Water	50 g	50 g	50 g	50 g	50 g

5        Each mixture of the above ingredients was blended and subsequently baked for 10 minutes in a 750-Watt domestic microwave oven, on maximum setting. An aerated mass with similar properties to those of Example 1 was obtained with Gums #11 and 12.

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### ***EXAMPLE 5***

#### ***Bread produced with Gum #5 and Maize Starch***

The flour mix used in this recipe is a blend of 500 parts maize starch to 60 parts soybean flour to 90 parts Gum #5.

Ingredients
580 g Flour
2 tablespoons (30 mL) dry yeast
2 teaspoons (10 mL) salt
1.5 tablespoons (22.5 mL) sugar
390 g water at 50 °C

5

Liberally grease a bread pan. Pre-heat an oven to 50 °C. Place all dry ingredients into a mixing bowl and mix. Add water (at 50 °C) and mix on low speed until combined. Keep mixing on medium speed until consistency is almost fluid. Turn out onto counter and lightly shape. Wait a minute or so before handling, as the dough cools it will form a light skin. Divide into 2 balls and place into bread pan. Place into pre-warmed oven and turn off the heat. Allow to rise for 20 minutes - If you allow it to rise longer, it will collapse more when full heat is applied. Turn heat up to 180 °C and bake for 40 minutes. When baked turn out immediately or steaming will occur.

10

### ***EXAMPLE 6***

#### ***Shortcrust Pies produced with Gum #5 and Maize Starch***

The flour mix used in this recipe is a blend of 500 parts maize starch to 60 parts soybean flour to 90 parts Gum #5.

Ingredients
350 g flour

Ingredients
80 g melted butter
1 teaspoon (5 mL) baking powder
1/2 (0.5) teaspoon (2.5 mL) salt
80 g caster sugar
80-90 g water (hot)
1 egg (60-65 g)
A little egg white
400 g mashed pie apples

Pre-heat an oven to 180 °C. Liberally grease four pie tins. Dissolve sugar in 80 g of water. Place all dry ingredients into a mixing bowl and mix. Add sugar water, egg and melted butter and mix on low speed with K beater. Keep mixing until consistency is pliable but not too fluid. Add water if required to achieve desired consistency. Turn out onto lightly floured counter and roll out to desired thickness. If dough crumbles or is hard to roll, re-mix with a few more mL of water. (Dough can be re-combined and re rolled many times.) Cut out pie bases and tops, place into greased pie tins. Lightly brush inside of pie shell with egg white. Fill each pie shell with approx 100 g of mashed pie apples.

5 Put tops onto pies and seal edges. Cut a slot into each top to allow for expansion of the filling during baking. Bake for 30 minutes at 180 °C.

10

#### **EXAMPLE 7**

##### *Chocolate Cake produced with Gum #5 and Maize Flour*

The flour mix used in this recipe is a blend of 500 parts maize starch to 60 parts soybean flour to 90 parts Gum #5.

15

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Ingredients
150 g flour
200 g caster sugar
35 g cocoa
60 g butter
120 g skim milk
3 teaspoons baking powder
1 teaspoon vanillin sugar
2 small (45-50 g) eggs

Pre-heat an oven to 180 °C. Add 2 teaspoons of baking powder to the flour. Add cocoa to flour and sift - ensure there are no lumps in the cocoa. Blend sugar, butter and 1 teaspoon vanillin sugar. When butter and sugar are blended add eggs and beat till creamy.

5 Mix in at low speed about 1/3 of the flour/cocoa and about 1/3 of the skim milk. Repeat until all the ingredients are combined - do not over beat. Pour into pan in layers and bake at 180 °C for 35 minutes

Throughout the specification the aim has been to describe the preferred 10 embodiments of the invention without limiting the invention to any one embodiment or specific collection of features. Those of skill in the art will therefore appreciate that, in light of the instant disclosure, various modifications and changes can be made in the particular embodiments exemplified without departing from the scope of the present invention. All such modifications and changes are intended to be included within the 15 scope of the appendant claims.

**CLAIMS**

1. A method of producing a gluten substitute gum, said method comprising heating a mixture comprising a starch, an edible fat, an edible protein and a liquid for a time and under conditions sufficient to form an aerated mass.
- 5        2. The method of claim 1, wherein the starch is present in an amount of between about 20 and 80% by weight of said mixture.
3. The method of claim 1, wherein the starch is present in an amount of between about 30 and 70% by weight of said mixture.
- 10      4. The method of claim 1, wherein the starch is present in an amount of between about 40 and 60% by weight of said mixture.
5. The method of claim 1, wherein the starch has less than 20 parts per million of gluten.
- 15      6. The method of claim 1, wherein the starch is selected from the group consisting of potato starch, sweet potato starch, white rice starch, glutinous rice starch, maize starch, Codex Alimentarius wheat starch, sorghum starch, cassava starch, arrowroot starch and tapioca starch.
7. The method of claim 6, wherein the starch is selected from the group consisting of tapioca starch, arrowroot starch and maize starch.
- 20      8. The method of claim 7, wherein the starch is tapioca starch.
9. The method of claim 1, wherein the fat is derived from an animal source or a plant source.
- 25      10. The method of claim 9, wherein the fat is selected from the group consisting of canola oil, corn oil, grapeseed oil, soybean oil, sunflower seed oil, safflower oil, rapeseed oil, cottonseed oil, sesame oil, olive oil, palm oil, coconut oil, fish oil, copha, margarine, butter, milk fat, chicken fat, lard and tallow, which may have been partially or completely hydrogenated or otherwise modified, non-toxic fatty materials having properties similar to triglycerides and any combination of the foregoing fats.

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11. The method of claim 1, wherein the fat is present in an amount of between about 1 and 10% by weight of said mixture.
12. The method of claim 1, wherein the fat is present in an amount of between about 1 and 6% by weight of said mixture.
- 5 13. The method of claim 1, wherein the fat is present in an amount of between about 1 and 4% by weight of said mixture.
14. The method of claim 1, wherein the fat to starch ratio in said mixture is less than about 15:100.
- 10 15. The method of claim 1, wherein the fat to starch ratio in said mixture is less than about 12:100.
16. The method of claim 1, wherein the fat to starch ratio in said mixture is less than 10:100.
17. The method of claim 1, wherein the protein is derived from an animal source or a plant source.
- 15 18. The method of claim 17, wherein the protein is derived from a source selected from the group consisting of meat, poultry, eggs, milk, cheese, bean flour, rice flour, nuts and any combination thereof.
19. The method of claim 18, wherein the protein is selected from the group consisting of gelatine, whey, egg white, soybean protein and rice protein.
- 20 20. The method of claim 1, wherein the protein is present in an amount of between about 2 and 20% by weight of said mixture.
21. The method of claim 1, wherein the protein is present in an amount of between about 2 and 12% by weight of said mixture.
- 25 22. The method of claim 1, wherein the protein is present in an amount of between about 2 and 8% by weight of said mixture.
23. The method of claim 1, wherein the protein to starch ratio in said mixture is less

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than about 30:100.

24. The method of claim 1, wherein the protein to starch ratio in said mixture is less than about 25:100.

25. The method of claim 1, wherein the protein to starch ratio in said mixture is less  
5 than about 20:100.

26. The method of claim 1, wherein the protein to fat ratio is about 3:1.

27. The method of claim 1, wherein the protein to fat ratio is about 2.5:1.

28. The method of claim 1, wherein the protein to fat ratio is about 2:1.

29. The method of claim 1, wherein the liquid is water.

10 30. The method of claim 29, wherein the water is present in an amount of between about 20 and 80% by weight of said mixture.

31. The method of claim 29, wherein the water is present in an amount of between about 30 and 70% by weight of said mixture.

15 32. The method of claim 29, wherein the water is present in an amount of between about 40 and 60% by weight of said mixture.

33. The method of claim 1, wherein the fat and the protein are obtained from or provided in the form of a foodstuff containing both the fat and the protein.

34. The method of claim 33, wherein the foodstuff is selected from milk, egg and vegetable products.

20 35. The method of claim 33, wherein the foodstuff is a gluten-free flour.

36. The method of claim 35, wherein the flour is selected from the group consisting of buckwheat flour, sorghum flour, maize flour, white rice flour and soybean flour.

37. The method of claim 35, wherein the flour is soybean flour.

38. The method of claim 1, wherein the mixture is heated to a temperature of

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between about 110 and 150 °C.

39. The method of claim 1, wherein the mixture is heated to a temperature of between about 120 and about 140 °C.

40. The method of claim 1, wherein the mixture is heated to a temperature of  
5 between about 125 and 135 °C.

41. The method of claim 1, wherein the mixture is heated to a temperature of between about 130 and 133 °C.

42. The method of claim 1, wherein heating is effected by microwave energy.

43. The method of claim 1, wherein heating is effected by extrusion.

10 44. The method of claim 1, further comprising drying the aerated mass to form a dry aerated mass.

45. The method of claim 44, further comprising grinding or crushing the dry aerated mass to form a ground or powder.

46. A gluten substitute gum produced by the method of claim 1.

15 47. A plurality of ingredients in mix or in kit form for producing a gluten substitute gum, said ingredients comprising a starch, an edible fat and an edible protein which are present in relative amounts sufficient to form an aerated mass upon mixing with a predetermined amount of liquid and heating the mixture so formed at an aerated mass-forming effective temperature.

20 48. The ingredients of claim 47, wherein the fat is present in an amount between about 0.5 and 5% by weight of the ingredients in said mix or kit.

49. The ingredients of claim 47, wherein the fat is present in an amount between about 0.5 and 3% by weight of the ingredients in said mix or kit.

25 50. The ingredients of claim 47, wherein the fat is present in an amount between about 0.5 and 2% by weight of the ingredients in said mix or kit.

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51. The ingredients of claim 47, wherein the fat to starch ratio in said mix or kit is less than about 15:100.

52. The ingredients of claim 47, wherein the fat to starch ratio in said mix or kit is less than about 12:100.

5 53. The ingredients of claim 47, wherein the fat to starch ratio in said mix or kit is less than 10:100.

54. The ingredients of claim 47, wherein the protein is present in an amount of between about 1 and 10% by weight of said the ingredients in said mix or kit.

10 55. The ingredients of claim 47, wherein the protein is present in an amount of between about 1 and 6% by weight of said the ingredients in said mix or kit.

56. The ingredients of claim 47, wherein the protein is present in an amount of between about 1 and 4% by weight of said the ingredients in said mix or kit.

57. The ingredients of claim 47, wherein the protein to starch ratio in said mix or kit is less than about 30:100.

15 58. The ingredients of claim 47, wherein the protein to starch ratio in said mix or kit is less than about 25:100.

59. The ingredients of claim 47, wherein the protein to starch ratio in said mix or kit is less than 20:100.

60. The ingredients of claim 47, wherein the protein to fat ratio in said mix or kit is 20 about 3:1.

61. The ingredients of claim 47, wherein the protein to fat ratio in said mix or kit is about 2.5:1.

62. The ingredients of claim 47, wherein the protein to fat ratio in said mix or kit is about 2:1.

25 63. Use of a starch, an edible fat and an edible protein in the preparation of a mix or kit for the production of a gluten substitute gum.

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64. A mix for the preparation of bakery products, said mix comprising the gluten substitute gum of claim 46 together with a gluten-free starch in relative amounts sufficient to form a coherent dough system upon the addition of a liquid, and to retain leavening gas during the preparation of said dough, wherein said products are producible in the  
5 substantial absence of wheat flour.

65. Use of the gluten substitute gum of claim 46 in the preparation of a mix for producing foodstuffs including bakery products.

66. A method for producing bakery products, said method comprising mixing the gluten substitute gum of claim 46 together with a gluten-free starch and water to form a  
10 dough and heating the dough for a time and at a temperature sufficient to produce said bakery products.

67. A food product produced using the gluten substitute gum of claim 46.

ABSTRACT

5

GLUTEN SUBSTITUTES

A method is disclosed for producing a gluten substitute gum. The method  
10 comprises heating a mixture comprising a starch, an edible fat, an edible protein and a  
liquid for a time and under conditions sufficient to form an aerated mass. This aerated  
mass largely mimics gluten and may be used in combination with flours, whether gluten-  
free or otherwise, to form doughs for producing bakery products including breads cakes  
and pastries.

DOCKET NO. 15353

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**GLUTEN SUBSTITUTES**

the specification of which

(check one)

[ ] is attached hereto.

[X] was filed on 13 Sept. 2000 as a United States Application No. or PCT International Application Serial No. PCT/AU00/01089  
and was amended on \_\_\_\_\_  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37 Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 (a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s):

Number	Country	Date of Filing Day/Month/Year	Priority Claimed Under 35 U.S.C. 119
47543/99	Australia	14 September 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Number)

\_\_\_\_\_  
(Filing Date)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35, United States Code, Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

PCT/AU00/01089  
Application Serial No.

13 September 2000  
Filing Date

Pending  
Status

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

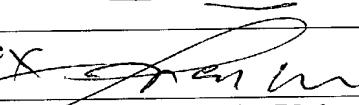
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